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**THE BIRDS OF THE SOUTHERN CORAL SEA INCLUDING OBSERVATIONS
BY HMS HERALD IN 1858-60**

BY

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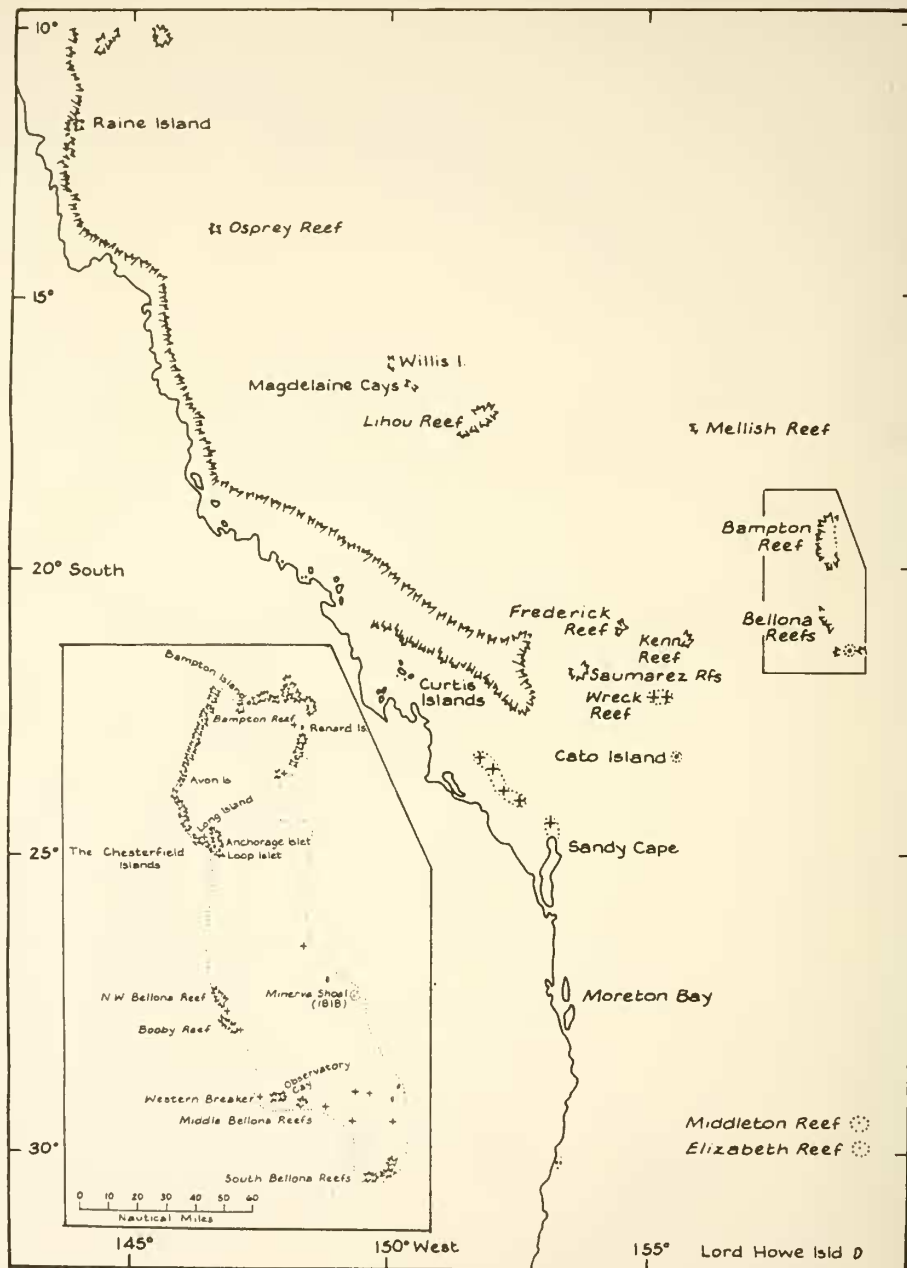


Figure 1. Index map of the Coral Sea showing details of the Chesterfield Islands.

THE BIRDS OF THE SOUTHERN CORAL SEA INCLUDING OBSERVATIONS BY HMS HERALD IN 1858-60

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W.R.P. BOURNE,¹ A.C.F. DAVID,² AND I.A.W. McALLAN³

It was hoped to include Terry Walker, who had visited most of the remoter islands in the Coral Sea in the course of preparing a seabird atlas, among the authors of this work until he failed to return from a trip in the Gulf of Carpentaria in May 1992 (Ogilvie and Hulsman, 1993). This contribution is therefore dedicated to his memory.

ABSTRACT

The log of HMS *Herald* when surveying reefs in the southern Coral Sea in 1858-60 shows that the little-known islands in this area were an important site for whales, turtles and seabirds (possibly including the Herald Petrel, *Pterodroma (arminjoniana) heraldica*, named after the ship) before they were devastated by whalers and guano-digging soon afterwards. This information is compared with more recent observations. While the slow-breeding, surface-nesting Herald Petrels and most of the Red-tailed Tropicbirds, *Phaethon rubricauda*, have not been found again, the vegetation and other more numerous bird populations appear to have largely recovered. While some birds may breed more or less continuously, there appears to be a peak for both birds and turtles in the spring in the south of the area and also in the autumn for the birds farther north, possibly due to the northward movement and increase in strength of the southeast trade wind in the winter. Individual birds' apparently erratic breeding behaviour may help them to avoid predators and parasites.

INTRODUCTION

One of the minor mysteries of marine ornithology concerns the origin of two identical medium-sized gadfly petrels, *Pterodroma* sp., said to have been collected on the Chesterfield Islands by John MacGillivray in the middle of the 19th century and eventually named *Oestrelata heraldica* by Salvin (1888). Presumably this was on the assumption that they must have been collected while MacGillivray was the naturalist in the *Herald*. During a study of the surveying voyage by Captain H.M. Denham in the *Herald* (David, 1995), WRPB and ACFD therefore looked for evidence for their origin.

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In 1995, IAWM independently examined a series of specimens from this voyage, apparently labelled by F.M. Rayner, surgeon in the *Herald*, and supplied by John Gould with a letter dated 13 August 1862 to Muscum Victoria in Melbourne, and found another specimen. These separate lines of research have revealed some other useful additional information about the islands.

The Chesterfield Reefs or Islands, and sometimes Group, are the most important of a number of uninhabited coral sand cays, some still awash and liable to shift with the wind and others stabilized by the growth of grass, creepers and low trees, lying on a series of reefs comprising the Chesterfield Reefs and extending from 19° to 22° S between 158-160 E in the southern Coral Sea halfway between Australia and New Caledonia (Fig. 1). The Chesterfield Reefs are now part of the territory of New Caledonia while the islands farther west are now part of the Australian Coral Sea Territory. They include the following main islets from south to north (Thiercelin, 1866; Anon., 1916; Hindwood et al., 1963):

Cato Island (23° 15' S, 155° 32' E), which lies 152 nautical miles (nm) NE of Sandy Cape and about 150 nm ESE of the southern end of the Great Barrier Reef, is a mound of coral debris measuring some 800m by 250m and 6m high covered in grass and creepers up to 1m high.

Bird Islet (22° 11' S, 155° 28' E), 64 nm to the north at the east end of Wreck Reef, is another mound measuring some 500m by 250m and 6m high with a bare centre surrounded by a ring of herbage. There are three other cays of which the first, Porpoise Cay, is 275m long, 90m across and 3m high with a few low plants, and the others are up to 120m long and 2m high lying about four miles apart along the reef to the west.

Observatory Cay (21° 16' S, 155° 48' E), at the south end of Kenn Reef 60 nm farther north, is about 100m by 50m and 2m high with a little vegetation and there are a number of other bare outlying cays scattered across this reef. There is a similar Observatory Cay (21° 02' S, 154° 23' E) on Frederick Reefs to the west and some cays on the Saumarez Reefs farther south.

Another Observatory Cay (21° 24' S, 158° 51' E), 800m long and 2m high, lies on the Middle Bellona Reefs at the southern end of the Chesterfield Reefs and 180 nm east of Kenn Reef.

Loop Islet (19° 59' S, 158° 28' E), which lies 85 nm farther north near the south end of the central islands of Chesterfield Reefs, is a small, flat, bushy islet 3m high where a permanent automatic weather station was established by the Service Météorologique de Nouméa in October 1968. Terry Walker reported the presence of a grove of *Casuarinas* in 1990.

Anchorage Islets are a group of islets five nautical miles north of Loop Islet. The third from the north, about 400m long and 12m high, shelters the best anchorage.

Long Island (19° 53' S, 158° 19' E), 10 nm NW of Loop Islet, is the largest of the Chesterfield Islands, and is 1400 to 1800m long but no more than 100m across and 9m high. Although wooded in the 1850s, it was stripped during guano extraction in the 1870s and was said to be covered in grass with only two coconut trees and some ruins at the south end early in the last century (Anon., 1916). The vegetation was growing again by 1957 when the remaining ruins were confused with those of a temporary automatic

meteorological station established in the same area by the Americans between 1944-48 (Pisier, 1979, Godard, nd). Terry Walker reported that by 1990 there was a ring of low *Tournefortia* trees growing around the margin, herbs, grass and shrubs in the interior, and still a few exotic species including coconuts.

One-to-three nautical miles south of Long Island and Loop Islet there are three small low islets up to 400m across followed, after a narrow channel, by Passage or Bennett Island, which is 12m high and was a whaling station in the first half of the last century. Several sand cays lie on the reef southeast of the islet.

The two Avon Isles (19° 32' S, 158° 15' E), some 188m in diameter and 5m high to the top of the dense vegetation, are situated 21 nm north of Long Island.

Renard Island (19° 14' S, 158° 58' E) lies 45 nm NE of the Avon Isles and is 273m long, 180m across and also 6m high to the top of the bushes.

Bampton Island (19° 08' S, 158° 38' E) lies on Bampton Reefs 20 nm NW of Renard Island. It is 180m long, 110m across and 5m high. It had trees when discovered in 1793, but has seldom been visited since then except by castaways.

Herald's Beacon Islet (17° 25' S, 155° 52' E), 170m by 120m and 2m high, lies on Mellish Reef 180 nm NW of Bampton Island.

There are also many cays on Lihou Reef halfway between Mellish Island and the coast of Queensland and more reefs to the northwest where a particularly useful comparative study has been carried out on Northeast Herald Cay (Comben, 2001).

HISTORY

Booby Reef in the centre of the eastern chain of reefs and islets comprising Chesterfield Reefs appears to have been discovered first by Lt. Henry Lidgbird Ball in HMS *Supply* on the way from Sydney to Batavia in 1790 (Collins, 1798; Findlay, 1851, 2: 1161). The reefs to the south were found next by Mathew Boyd (ms) in the convict ship *Bellona* on his way from Sydney to Canton in February-March 1793. The following June, William Wright Bampton (ms) became embayed for five days in the reefs at the north end of Chesterfield Reefs in the Indiaman *Shah Hormuzeer* with Mathew Bowes Alt (ms) in the whaler *Chesterfield*, and reported two islets with trees and "a number of birds of different species around the ships, several of them the same kind as at Norfolk Island" (Collins, 1798; Flinders, 1814; Pisier, 1979).

Cato Island, and then Bird Islet, were found by Captain John Park in the Indiaman *Cato* and Lt. Robert Fowler in HMS *Porpoise* on 17 August 1803. The latter ran aground on Wreck Reef. Matthew Flinders (1814) on the *Porpoise* reports that all the cays held many birds, laying in the period August-October. On Bird Islet they included gannets, boobies, man-of-war birds, tropic birds and noddies. There were also turtles of up to 208 kg and many Humpbacked Whales in the lee of the reef.

The reefs continued to present a hazard to shipping plying between Australia and Canton or India (where cargo was collected on the way home to Europe) and in due course the southern reefs were surveyed by Captain H.M. Denham (ms, 1860) in the *Herald* in 1858-60, who made natural history notes discussed below, and the northern

ones by Lt G.E. Richards in HMS *Renard* in 1878 (Richards, 1878) and the French the following year (Chevron, 1880; Rageau and Vervent, 1958).

The area was also visited by increasing numbers of whalers during the off-season in New Zealand in search of the many wintering Humpbacked and fewer Sperm Whales (Townsend, 1935) in the middle of the 19th century as described by Thiercelin (1866). He reports that in July 1863 the islets only had two or three plants, including a bush 3-4 m high, and were frequented by turtles weighing 60-100 kg, paille-en-queues, fous, pétrels 'etc.', a petit oiseau noir (noddy?), and a coq de bruyère (rail?). Many eggs were being taken regularly by several English, two French and one American whaler. On another occasion there were no less than eight American whalers (*Moniteur de la Nouvelle Calédonie*, 5 July 1863, quoted by Pisier, 1979). A collection of birds said to have been made by Surgeon Jourde of the French whaler *Général d'Hautpoul* on the Brampton Shoals in July 1861 was subsequently brought by Gerard Krefft (1862) to the Australian Museum, but clearly not all the specimens came from there.

On 27 October, 1862, the British Government granted an exclusive concession to exploit the guano on Lady Elliot Island, Wreck Reef, Swain Reefs, Raine Island, Bramble Cay, Brampton Shoal, and Pilgrim Island (not located, possibly somewhere off Western Australia?) to the Anglo-Australian Guano Company organised by the whaler, Dr. W.L. Crowther in Hobart, Tasmania. They were apparently most active on Bird Islet (Wreck Reef) and Lady Elliot and Raine Islands (Hutchinson, 1950), losing five ships at Bird Islet between 1861 and 1882 (Crowther 1939). It is not clear that they ever took much guano from the Chesterfield Islands unless it was obtained from Higginson, Desmazures et Cie, discussed below.

When in 1877 Joshua William North also found guano on the Chesterfield Reefs, Alcide Jean Desmazures persuaded Governor Orly of New Caledonia to send the warship *La Seudre* to annex them. There were estimated to be about 185,000 cu m of guano on Long Island and a few hundred tons elsewhere, and 40-62% phosphate (Chevron, 1880), which was extracted between 1879-88 by Higginson, Desmazures et Cie of Nouméa (Godard, nd), leaving Long Island stripped bare for a time (Anon., 1916).

Apparently the islands were then abandoned until Commander Arzur in the French warship *Dumont d'Urville* surveyed the Chesterfield Reefs and erected a plaque in 1939 (Cohic, 1959). In September 1944, American forces installed a temporary automatic meteorological station at the south end of Long Island, which was abandoned again at the end of World War II (Rageau and Vervent, 1958).

The first biological survey was made of Long Island by Cohic (1959) during four hours ashore on 26 September, 1957. It revealed among other things a variety of avian parasites including a widespread *Ornithodoros* tick (Rageau & Vervent, 1958) belonging to a genus carrying arboviruses capable of causing illness in man (Bourne, 1989). This island and the Anchorage Islets were also visited briefly during a survey of New Caledonian coral reefs in 1960 and 1962 (Chevalier, 1964). Those islands belonging to Australia and their birds and parasites were surveyed in September-October 1960 and October-November 1961 by Hindwood et al. (1963).

An aerial magnetic survey was made of the Chesterfield area in 1966 (Pisier, 1979), and a seismic survey in 1972 (Godard, nd), which apparently have not been followed up

yet. In November 1968 another automatic meteorological station was installed on Loop Islet where 10 plants were collected by A.E. Ferré (Guillaumin & Veillon, 1969). Since then the Centre de Nouméa of the Office de la Recherche Scientifique et Technique Outre-Mer has arranged for periodic surveys by Rancurel (1974a,b), Condamin (1977) and others when this installation is serviced. The ornithological observations are summarized by Naurois & Rancurel (1978a,b).

Since 1982, Terry Walker had been carrying out methodical surveys of the Coral Sea islets with the intention of producing a seabird atlas, including a visit to the central islands of the Chesterfield Reefs in December 1990 (Heatwole & Ménéz n.d., Tables 1 and 2). It appears from his records to have been about half finished when he was lost, and the Department of Environment and Heritage, which has his records, has made a commitment to complete it (Ogilvie and Hulsman, 1993).

The Observations by HMS *Herald*

The *Herald* left Britain in 1852 and had been surveying in the southwest Pacific area for over five years by the time she reached the Coral Sea (David, 1995). In this time her officers and crew had clearly become very familiar with insular wildlife and appear to have collected birds at every opportunity. Every boat that went ashore would also take 'upwards of a hundred dozen' eggs when available. Although the official naturalist, John MacGillivray (Ralph, 1993), had been dismissed in Sydney in April 1855, Captain Denham was still recording natural history observations in his own journal and the species seen were also listed on the track chart by someone whose writing differs from that of others mentioned.

According to MacGillivray, the surgeon F.M. Rayner was also collecting birds for the Royal Naval museum at Haslar Hospital (later including the type of *Procellaria macgillivrayi* of Gau, Fiji: Watling and Lewanavanua, 1985). Alternatively they, and later a new Assistant Surgeon, G.B. Beale, may have sent them to the Hydrographer of the Navy, Admiral Sir Francis Beaufort. Wherever they originally sent their specimens, they eventually reached one of Beaufort's correspondents, John Gould, who passed some of the most interesting, such as the types of the Tristan Thrush *Nesocichla eremita* and Fiji Petrel *Pseudobulweria macgillivrayi*, to the British Museum. Most or all of the remaining specimens were acquired by Frederick McCoy, founder of the National Museum of Victoria (now Museum Victoria), including at least 14 collected in the SE Coral Sea by Rayner in September- November 1858 and five collected there by Beale in May-September 1859. One is a Herald Petrel *Pterodroma (arminjoniana) heraldica*, presumably taken with the two now in the (British) Natural History Museum.

Surveys by Denham in the Coral Sea

3 September- 19 December 1858: Sydney, South and Middle Bellona Reefs, Wreck Reef, Cato Island, Cape Moreton, Sydney.

11 April- 14 October 1859: Sydney, Middle Bellona Reef north to Bampton Reef, Kenn Reef, Frederick Reefs, Saumarez Reefs, Percy Isles, Cato Island, Wreck Reef and Bird Islet, Mellish Reef, Lihou Reef, running survey of Great Barrier Reef, Moreton Bay, Sydney.

21 January- 23 May 1860: Sydney, Mellish Reef, Lihou Reef, Willis Islets, Osprey Reef, Raine Island, Herald Cays, Magdelaine Cays, Mellish Reef, Sydney.

17 August- 19 September 1860: Homeward bound, Kenn Reef, Frederick Reefs, running survey of outer edge of Great Barrier Reef, Herald's Surprise, Holmes Reefs, Raine Island.

Since the inner islands are better-known and the marine biology and lesser plants still comparatively undisturbed, we shall confine our attention to the larger wildlife of the seldom-visited outer islands devastated by guano extraction shortly afterwards, citing the scientific names used at the time, and discuss the identity of the birds later.

Denham reports that around the Bellona Reefs in September 1858 they saw many sharks *Carcharinus* (one that was caught had a Hawksbill Turtle in its stomach), Humpbacked Whales *Megaptera*, Sperm Whales *Catodon*, Finner Whales *Physalus*, Blackfish *Globiocephalus*, Boatswain Birds *Phaeton phoenicurus*, Masked and Brown Gannets *Sula personata* and *S. fusca*, man-of-war birds *Tachypetes* and "common" terns *Sterna* at sea. They found only 18 Green Turtles *Chelonia marmorata* weighing 1615 kg, Masked and Brown gannets, Sooty Terns *Onychoprion fuliginosus* and the tern *Sterna nereis* breeding on the bare sand cay where all the guano had been washed away by storms. The following April, while there were still turtles at sea, there were now only hatching turtle eggs ashore and many fewer birds, which were just starting to lay again.

When they visited Bird Islet, Wreck Reef, on 9 October 1858, Denham reported that it was composed of pale grit, half a mile round and 12 ft high, with a bare centre surrounded by tufts of rank grass *Rottboilla* of Endliche and creepers of the families Portulacaceae and Nyctaginaceae etc, with polluted fresh water seeping from crevices. It was covered with nesting gannets, man-of-war birds, terns and noddies breeding in separate groups so that the colony was divided into five sections. There were a few Hawksbill Turtles *Caretta imbricata* in the lagoon and many Humpback and Finner whales and a school of Sperm Whales offshore. Rayner identified the birds as *Puffinus carneipes*, *Sula australis*, *S. personata*, *S. fusca*, *S. piscator* or *rubripes*, *Tachypetes*, *Phaeton phoenicurus*, a *Limosa*, *Sterna melanorhyncha*, *S. gracilis*, *Onychoprion fuliginosa*, *Anous cinereus* and *A. leucopillus*.

Three days later Denham reported Cato Island was more substantial than other cays in the area, measuring 1/3 by 1/6 miles, rising to 19 ft, and covered in coarse tufted grass *Rottboilla*, a creeping plant *Nyctagin portulaca* and a sort of buttercup *Senebiera crucifera* undermined and fertilised by burrowing mutton-birds, the only species that the sailors wished to eat. There were again dense colonies of gannets, man-of-war and Boatswain Birds, terns and noddies, with eggs and chicks, and he shot a godwit and a brace of plovers. There were records of repeated visits by whalers but now only one

Humpback offshore. Rayner also recorded a *Limosa*, *Charadrius*, *Strepsilas interpres*, and a landrail. When they returned with plants from the Percy Isles and seeds from Sydney to provide succour for castaways in August, 1859 Denham again reported that the birds formed a cloud hovering 60 feet above the island, though "a few visits like ours would tend to check the accumulation in proportion to each boat bringing off upwards of 100 dozen eggs at a three hours gleaning!"

In May 1859, Denham found Long Island was "a heap of "foraminifera" densely covered with stunted bush-trees with leaves as large as cabbage plants, spreading 12 feet (3.7 m) and reaching as high, upon trunks 9 inches (23 cm) diameter... The trees around the margin of this island were leafless, as if from the sea-fowl (gannet, man-of-war bird and boatswain bird) roosting and nesting, instead of laying upon the ground as at Cato Island and Bird Islet, which would seem to be a habit on account of the ground being too much shaded for sun-hatching, as also in some degree, perhaps, to avoid the snakes (presumably breeding sea snakes). The mutton-birds burrowed, and were more successfully bagged by our boats' crews, than at the open-surface islets... A land-bird (a rail), of the size of a plover, black and scantily speckled, was found in numbers feeding on insects..."

The Avon Isles to the north were also "densely covered with stunted trees and creeping plants and grass, and... crowded with the like species of birds... the small tern *Sterna gracilis*... the Sooty Tern *Onychoprion fuliginosus*... the Black Noddy *Anous stolidus*... the gannets, some with red legs, *Sula fusca*, *S. australis* and *S. piscator*... with the man-of-war birds *Tachypetes ariel* and *T. aquila*. We also found the land-bird already described and of which I retained good specimens. These isles afforded but few mutton birds, but as the boats' crews became adept at birds' nesting, and as this was evidently the laying season, each boat (brought) on board three or four buckets of eggs. At first they were chiefly addled, but after clearing all the nests a fresh lay took place..."

The list of the fauna observed on the *Herald's* Track Chart includes a *Procellaria*, *Puffinus carneipes*, *Attagen ariel*, *Phaeton phoenicurus*, *Sula australis*, *S. personata*, *S. rubripes*, *Rallus pectoralis*, *Charadrius xanthocheilus*, *Limosa uropygialis*, *Strepsilas interpres*, a *Sterna*, *Onychoprion fuliginosus*, *Anous stolidus*, *A. cinereus*, *A. leucocapillus*, *Chelonia marmorata*, *Catadon australis*, *Globicephalus macrorhynchus*, *Megaptera* and *Physalus*. In addition to the rail, Denham reports that a sooty tern, a noddy and a booby were collected. There are two sooty terns from the Avon Isles, a buff-banded rail from the Chesterfield Reefs, and a bar-tailed godwit, black noddy and tree martin *Hirundo nigricans* from Observatory Islet on Middle Bellona Reefs in Museum Victoria.

The *Herald* next surveyed Kenn Reef "and its bare white sand cays" between 25 May- 6 June. "At present these cays are scarcely six feet above high-water level but, nevertheless, are so protected from the ocean surge by the rim of the outer reef as to allow vegetation, which, though not discernible afloat, consists of the like creeping plant which we had seen on the windward cays and whereupon the Black Noddy *Anous stolidus*, the only bird I saw there, lays eggs...". Surveys were carried out on Frederick Reefs between 10-13 June, which also had some vegetation, eggs and chicks of Black Noddies *Anous leucocapillus*, sharks, and a middle-sized Green Turtle.

A visit to Saumarez Reefs between 17-20 June was interrupted by a storm during which they retired to Kenn Reef. When they returned to Saumarez Reefs during 24-30 June they found gannets, noddies and frigate-birds occupying the cays. Finally, when they visited Herald Beacon Cay on Mellish Reef in August the ship's rigging was covered in roosting boobies, which returned throughout their stay.

Denham's conclusions are engraved on British Admiralty Chart 349:

"These Plans and a mast-head Lookout will enable a Ship to round to under the lee of the Reefs where she may caulk topsides, set up rigging, rate Chronometers, [and] obtain turtle, fish and seafoal eggs. On some of the more salient reefs, beacons were erected by Capt'n Denham, and for the sake of castaways, cocoa-nuts, shrubs, grasses & every description of seed likely to grow, were sown in the way to promote the superstructure; and it is most desirable that these Refuge- spots should be held sacred for universal benefit and not ruthlessly destroyed by the Guano-seeker."

THE BIRDS

Diomedea exulans Wandering Albatross. Hindwood et al (1963) saw an immature near Cato Island on 6 October 1960.

Daption capense Cape Petrel. One followed the *Herald* from Breaksea Spit off Sandy Cape, south Queensland, to Cato Island in August 1859.

Pachyptila vittata Broad-billed Prion? A 'Broad-billed Whalebird *Prion vittatus*' was reported by Denham off the south end of the South Bellona Reef on 17 September 1858. There may have been confusion with the smaller gadfly petrels discussed below which appear to have been mistaken for more southerly species at a number of other places in the tropical Pacific.

Pterodroma (arminjoniana) heraldica Herald Petrel. For a long time this form was only known from two specimens in the pale phase in the (British) Natural History Museum said to have been taken by the *Herald* on the Chesterfield Islands. They were identified by Murphy and Pennoyer (1952) as a poorly-defined small South Pacific population of the southern Indo-Atlantic Trindade Petrel *P. arminjoniana*, though molecular analyses now suggest the systematics of these birds is more complicated (Brooke and Rowe, 1996). A few arc now also known to breed on Raine Island towards the north end of the Australian Great Barrier Reef, possibly laying about August (King and Reimer, 1991). It is said to occur in the New Caledonian area (Barré and Dutson, 2000), but details have yet to be published in full (Spaggiari and Barré, 2005), and it is seen at intervals in the western Coral Sea including one north of Cato Island on 16 May 1981 (Stokes and Corben, 1985). Most appear to lay a little later, in September, in the South Atlantic (Olson, 1981) and South Pacific (Bourne and David, 1983), and not until November on Round Island off Mauritius (Gardner et al., 1985).

In fact, one of these specimens (62.6.22.10) was originally found among 32 skins

of unknown origin in other parts of the world obtained by the Natural History Museum from John Gould on 22 June 1862. The museum acquired the similar type (88.5.18.110), said to have been taken by MacGillivray (Salvin, 1888), in the Salvin-Godman collection in 1888 and Museum Victoria has another (B.17189 "*Procellaria phillipi*"), also in the light phase, among the specimens obtained by the *Herald* in the Coral Sea received from Gould in 1862. They may be the "*Procellaria*" listed opposite the central islands of the Chesterfield Reefs on *Herald's* track chart but, if so, they cannot have been taken by MacGillivray who had by then left the ship.

Alternatively, they may have been obtained by MacGillivray during a simultaneous trip from Australia to Vanuatu where he presumably collected two Collared Petrels *Pterodroma (leucoptera) brevipes* on Aneityum in February and March 1859, now in the Natural History and Leiden Museums, which he named *Procellaria torquata* (MacGillivray 1860), three undated specimens of the last form in the Salvin-Godman Collection, and seven White-throated Storm-petrels *Nesofregatta fuliginosa* obtained on Aneityum in January 1860 distributed between these collections and Museum Victoria. But if so, they cannot have come from the *Herald*. The simplest solution, however, seems to be to accept the traditional origin, collection by the *Herald* in the Chesterfield Islands.

Pterodroma rostrata Tahiti Petrel. A dark petrel with a white belly seen by Hindwood et al (1963) several times off the Australian coast has subsequently been identified as this species was thought to move south with warm Coral Sea waters in January and February (Holmes, 1981; Stokes and Corben, 1985). Possible birds were described by J.B. Mitchell over the Lord Howe Seamounts at 20°45' S, 158° E on 24 October 1963, and two next day at 22° S, 156° 15' E (Bourne, 1964). One has recently been seen by Neil Cheshire at 18° 00' S, 160° 10' E, 93 nm ENE of Bampton Reef on 14 October 1985, another at 22° 30' S, 159° 03' E, 35 nm SW of South Bellona Reef, on 9 October and a third at 24° 53' S, 159° 24' E, 176 nm south of South Bellona Reef on 10 October 1988. Stokes and Corben (1985) are incorrect in stating it breeds in the Chesterfield Islands. In addition to the breeding data for New Caledonia cited by Naurois (1978), there is a chick with sprouting feathers in the (British) Natural History Museum obtained by E.L. Layard at Woodin Pass, New Caledonia on 3 November 1877. It has also been reported breeding on Îles Belep at the northwestern end of New Caledonia (V. Bretagnolle in Barré and Dutson 2000) which is thus the closest breeding point to the Chesterfield Reefs.

Pterodroma leucoptera Gould's Petrel. This species, which breeds in New Caledonia in one direction and New South Wales in the other, was reported at sea on 17 April 1974 a day before arriving at Loop Islet from New Caledonia (Rancurel, 1974a) and one was seen north of Cato Island on 16 May 1981 (Stokes and Corben, 1985). In addition to the breeding data for New Caledonia cited by Naurois (1978) there is a downy chick in the (British) Natural History Museum obtained by E.L. Layard in New Caledonia on 11 April 1877. (The similar Black-winged Petrel *Pterodroma nigripennis* is also likely to occur as it has been recorded breeding on islets farther east in New Caledonian waters, Barré and Dutson, 2000).

Puffinus carneipes Flesh-footed Shearwater. While this species was reported by Rayner at Bird Islet and on *Herald's* track chart, the next species is not, so they may have been confused. Hindwood et al (1963) also saw a few off the western reefs, presumably feeding birds from Lord Howe Island to the south.

Puffinus pacificus Wedge-tailed Shearwater. "Mutton- birds" have been seen offshore or their burrows found on at least Cato Island, Bird Islet, Long Island, the Avon Isles and Loop Islet by most visitors. While Denham failed to record them around Bellona Reefs in September 1858, apparently they had arrived at Cato Island by mid-October. Condomin (1977) also saw birds at sea but found the burrows still unused ashore on Loop Islet in early October 1977 though he reports that Ferré saw them ashore at the end of October. Rancurel (1974a) found large chicks here on 18 April 1974 and Denham found a few still present on Long Island and the Avon Isles in April-May 1859, thus it appears that, as usual, they must breed in the summer and leave in the winter. Terry Walker reported it still breeds commonly on Cato Island, Bird Islet and the central islands of the Chesterfield Reefs.

Pelagodroma marina White-faced Storm-petrel. Stokes and Corben (1985) saw one near Cato Island on 16 May 1981.

Fregetta tropica Black-bellied Storm-petrel. Neil Cheshire saw one at 18 00 S, 160 10 E, 93 nm ENE of Bampton Reef on 14 October 1985, presumably returning from wintering farther north.

Fregetta grallaria White-bellied Storm-petrel. Hindwood et al (1963) report about 10 off Cato Island on 6 October 1960 and others to the south. Norris (1967) saw one at 22 S, 156 E on 23 August 1961, and Stokes and Corben (1985) saw two north of Cato Island on 16 May 1981, presumably from Lord Howe Island.

Sula dactylatra Masked Booby. Denham recorded *Sula personata* breeding on Observatory Cay on Middle Bellona Reefs in September 1858. It was listed as occurring at Bird Islet the following month and Denham listed it again on the central islands of the Chesterfield Reefs the following April-May. Cohic (1959) found them breeding on Long Island on 26 September 1957 on the ground among clumps of *Triumfetta*, *Boerhavia* and *Lepturus* and Rancurel (1973, 1974a) found them starting to breed on the Anchorage Islets in April 1973. By 18 April 1974 they had finished incubating on Loop Islet and the adults were away by day and only returned to feed large chicks on flying fish in the evening. Naurois and Rancurel (1978a) report they lay one or two eggs near *S. leucogaster* at the top of the beach on the edge of the *Sesuvium* but normally rear only one chick and conclude that most must nest seasonally in the spring as appears to be usual in this area (Marchant and Higgins, 1990). Condomin (1977) found 55 breeding on Loop Islet on 2-3 October 1977 (when one regurgitated a flying fish *Prognichthys*) and a few more outnumbered by *S. leucogaster* on the Anchorage Islets and Long Island next day. Terry Walker reported it still breeds commonly on Cato Island, Bird Islet and the

central islands of the Chesterfield Reefs and Hindwood et al (1963) that it also breeds on Herald's Beacon Islet on Mellish Reef, Porpoise Cay on Wreck Reef, and was seen on North Cay on Mellish Reef and Observatory Cay on Kenn Reef. A chick ringed on the Chesterfield Islands by H. Heatwole on 10 December 1990 was recovered dead on Nafinua Island in the Solomons (10°40' S, 162°15' E) on 27 November 1992 (Corella 1992:163). The birds breeding on the Chesterfield Islands, and presumably elsewhere in the area, are the yellow-eyed subspecies *S.d. personata* (see photograph in Hannecart & Letocart, 1983). However, it is likely that nonbreeding members of the dark-eyed subspecies *S.d. tasmani* are regular visitors as there are many recoveries of birds ringed at Lord Howe Island and Norfolk Island from Raine Island, New Caledonia and Vanuatu.

Sula leucogaster Brown Booby. Denham found *Sula fusca* nesting on Observatory Cay on South Bellona Reefs in September 1858, Rayner lists it as occurring at Bird Islet in the following month, and it is listed again on the track chart off the central islands of the Chesterfield Reefs in the following April-May. Cohic (1959) reported that they appeared to lay two or three eggs but only rear one chick on Long Island on 26 September 1957. Condamin (1977) found only 21 on Loop Islet on 2-3 October 1977 although they were the commonest booby on the Anchorage Islets and Long Island next day. Rancurel (1974a) saw many young at sea and found old birds starting to nest again ashore on 18 April 1974. Naurois and Rancurel (1978a) report that they lay two eggs in scattered nests and conclude that unlike the other sulids they must breed continually. Terry Walker reported it still breeds commonly on Cato Island, Bird Islet and the central islands of the Chesterfield Reefs and Hindwood et al (1963) that it breeds on Southwestern Extreme Cay off Kenn Reef, Herald's Beacon Islet on Mellish Reef and Porpoise Cay on Wreck Reef. It was also seen on West Islet and an unnamed cay on Wreck Reef.

Sula sula Red-footed Booby. *S. piscator* or *rubripes* were listed at Bird Islet in October 1858, when Rayner took male and female young birds now in Museum Victoria. Denham also noted the presence of gannets "with red legs" at Long Island and the Avon Isles in April-May 1859 when *Sula rubripes* appeared on the track chart. On 26 September 1957, Cohic (1959) found nests with single eggs in *Sophora tormentosa* and *Scaevola sericea* on Long Island. Rancurel (1973, 1974a) reported eggs and young present in April 1973 when many young attended the fishing offshore and some birds were building on Loop Islet. Few had eggs or young in April 1974. Naurois and Rancurel (1978a) reported both the white and brown morphs, which may help explain some of the confusion on the *Herald* over the sulids occurring in the area. Condamin (1977) reported 300 nests in all stages of the breeding cycle in *Argusea argentea* on Loop Islet on 2-3 October 1977 and a few on the Anchorage Islets and Long Island next day. Thus it would appear that most must nest in the spring. The adults regurgitated the squid *Symplectoteuthis oualaniensis* and flying fish. Terry Walker reported a few still breed on Cato Island and Bird Islet and more on the central islands of the Chesterfield Reefs, and Hindwood et al (1963) also saw it on Observatory Cay on Kenn Reef and Mellish Reef.

Morus serrator Australasian Gannet. Flinders (1814) reported that both gannets and boobies were present at Bird Islet on its discovery in 1803 and Rayner includes *Sula australis* among birds seen there in October 1858. Denham also includes it among those present around the central islands of the Chesterfield Reefs in April-May 1859 when it was listed on *Herald's* track chart for that area though absent off Raine Island farther north. While even Bird Islet and the Chesterfield Reefs seem unusually far north for *S. serrator*, all the other local sulids were also reported. This species is usually found close to the coast in Queensland, with records as far north as 19°14' S (Storr, 1984).

Phalacrocorax sulcirostris Little Black Cormorant. Condamin (1977) saw a small group on Loop Islet on 2-3 October 1977 and probably the same 10 on the Anchorage Islets next day.

Fregata minor Great Frigatebird. This is presumably a species recorded by Denham as *F. aquila* in the central islands of the Chesterfield Reefs in April-May 1859. Rancurel (1973, 1974a) found eggs and young on Long Island and the Anchorage Islets in April 1973 and thought it was starting to breed on Loop Islet on 18 April 1974. Cohic (1959) found nests in *Scaevola sericea* and grass clumps in the open on Long Island on 26 September 1957 and Condamin (1977) found 60 nests with eggs and young in *Abutilon indicum* and *Argusia argentea* there on 4 October 1977. Terry Walker said it breeds commonly on the central islands of the Chesterfield Reefs with a few on Cato Island.

Fregata ariel Lesser Frigatebird. Denham saw man-of-war birds at sea around the Bellona Reefs in September 1858 and breeding at both Bird Islet and Cato Island the following month. Both *Tachypetes ariel* and *T. aquila* had red pouches on the northern islands in April-May 1859 while *Attagen ariel* was listed on *Herald's* track chart. F.M. Rayner collected a male, now in Museum Victoria on Bird Islet on Wreck Reef, in October 1858. It was found with eggs and young on "Brampton Shoals" in July 1861 (Krefft, 1862). Hindwood et al. (1963) found it breeding on Bird Islet and Cato Island and Cohic (1959) found nests with eggs in *Sophora tomentosa* on Long Island on 26 September 1957. Rancurel (1973) only saw it flying over the Anchorage Islets in April 1973 and, although Condamin (1977) saw none on Long Island in early October 1977, frigates were said to be breeding again on one of the Anchorage Islets. Thus it seems possible that they may breed in the spring although Rancurel (1974a) also thought that they might be starting to breed on Loop Islet on 18 April 1974. Terry Walker reported it still breeds commonly on Cato Island, Bird Islet on Wreck Reef and the central islands of the Chesterfield Reefs.

Phaethon rubricauda Red-tailed Tropicbird. Denham reported *P. phoenicurus* at sea around the Bellona Reefs in September 1858 and breeding on Cato Island the following month. It was listed again on *Herald's* track chart off the central islands of the Chesterfield Reefs in April-May 1859 and there are two collected by F.M. Rayner during the voyage of the *Herald* on Bird Islet on Wreck Reef in October 1858 in Museum Victoria. Jourde found small young on "Brampton Shoals" in July 1861 (Krefft,

1862). Thiercelin (1866) reports paille-en-queues in the Chesterfield Islands in 1863. *P. rubricauda* has been reported to occur again more recently by Pisier (1979) and Rancurel (1973, 1974a) saw a probable bird over Long Island in April 1973 and one at sea on 17 April 1974 the day before arriving at Loop Islet. Terry Walker also thought it may breed on the central islands of the Chesterfield Reefs. Thus, although Naurois and Rancurel (1978b) say it has not been found breeding any nearer than Surprise Island on the d'Entrecasteaux reefs to the north and Walpole, Mathew and Hunter Islands to the east, it may also survive in this area as well although it has apparently gone from most of the inshore islands except northeast Herald Cay (King, 1993; James; 2001).

Phaethon lepturus White-tailed Tropicbird. Seen at sea by Hindwood et al (1963) on 9 October 1960 at 23 10 S, 154 E, between Cato Island and the mainland, by Rancurel (1974a) on 17 April 1974 a day before arriving at Loop Islet, again by Condamin (1977) on the way to the islands in early October 1977, and two by Neil Cheshire at 18 00 S, 160 10 E, 93 nm ENE of Bampton Reef on 14 October 1985 though Naurois and Rancurel (1978b) report that it does not breed nearer than Walpole, Mathew and Hunter Islands.

Gallirallus philippensis Buff-banded Rail. Rayner reported a "landrail" on Cato Island on 12 October 1858 and G.B. Beale in the *Herald* collected a female, now in Museum Victoria, in the central Islands of the Chesterfield Reefs in May 1859. Denham recorded the presence of an agile rail, which fed on insects on Long Island and the Avon Isles in April-May 1859, identified as *Rallus pectoralis* (then used for *R. philippensis*) on the track chart. Joude found it on "Brampton Shoals" in July 1861 and a darker bird thought to be a female (Krefft, 1862). Thiercelin (1866) also reported hunting a coq de bruyère there in 1863. Rancurel (1974a) saw a number on Loop Islet on 18 April 1974 but Condamin (1977) could only find one here on 2-3 October 1977 with another on the Anchorage Islets and several on Long Island the next day. Terry Walker reported that a few breed on Cato Island and Bird Islet and more on the central islands of the Chesterfield Reefs. Schodde and Naurois (1982); Marchant and Higgins, 1993) made Long Island the type locality of the debatable race of *G. p. tounelieri* found on islets on the Great Barrier Reef and in the Coral Sea.

Pluvialis fulva Pacific Golden Plover. Denham shot a brace of plovers on Cato Island on 12 October 1858 and *Charadrius xanthocheilus* is listed on *Herald's* track chart. Froude took one on "Brampton Shoals" in July 1861 (Krefft, 1862). Hindwood et al. (1963) saw over 20 on Bird Islet and Condamin (1977) four on the Anchorage Islets on 4 October 1977. It had also been recorded by A.E.Ferré. Terry Walker reported them from Cato Island, Bird Islet and the central islands of the Chesterfield Reefs.

Arenaria interpres Ruddy Turnstone. *Streptilas interpres* was reported by Rayner on Cato Island on 12 October 1858 and was listed again on the *Herald's* track chart. Hindwood et al (1963) found it the commonest shorebird on the islands with a maximum of 60 on Cato Island. Condamin (1977) saw 12 on Loop Islet on 2-3 October 1977 and others on the Anchorage Islets and Long Island next day. Terry Walker reported them from Cato Island, Bird Islet and the central islands of the Chesterfield Reefs.

Heteroscelus brevipes/incanus Tattler sp. Froude took *Totanus griseopygius* on "Brampton Shoals" in July 1861 (Krefft, 1862) and there is an *incanus* of uncertain origin in the Australian Museum that could be the specimen concerned. Hindwood et al (1963) report tattlers from Bird Islet and West Islet on Wreck Reef and Condamin (1977) from the Anchorage Islets on 4 October 1977. Terry Walker reported them from Cato Island, Bird Islet and the central Islands of the Chesterfield Reefs. *H. incanus* is the common tattler on the islands east of Australia.

Calidris alba Sanderling. Condamin (1977) saw one among the shorebirds on the Anchorage Islets on 4 October 1977.

Limosa lapponica Bar-tailed Godwit. Denham reported *Limosas* on Observatory Cay on Middle Bellona Reefs in September 1858 and on Cato Island and Bird Islet the following month. A body now in the Australian Museum was taken by F.M. Rayner on Observatory Cay on Middle Bellons Reefs in September and another on Cato Island in October 1858. *L. uropygialis* is also listed on the *Herald's* track chart. Froude took birds on "Brampton Shoals" in July 1861 (Krefft, 1862). Hindwood et al. (1963) reported it from Observatory Cay on Kenn Reef, Bird Islet and Cato Island, and Terry Walker from Cato Island, Bird Islet and the central islands of the Chesterfield Reefs.

Numenius minutus Little Whimbrel. Hindwood et al (1963) found a body on *Herald's* Beacon Islet, Mellish Reef, on 26 November 1961.

Sterna bergii Crested Tern. Hindwood et al (1963) saw it on Wreck Reef. Rancurel (1974a) found five to six birds with eggs on Loop Islet on 18 April 1974 and Condamin (1977) saw two there on 2-3 October 1977. Terry Walker reported they occurred on Cato Island and Bird Islet and a few bred on the central islands of the Chesterfield Reefs.

Sterna hirundo and/or *S. dougallii* Common or Roseate Terns. Denham reported "common" terns over South Bellona Reefs in September 1858, Rayner both *Sterna melanorhyncha* (Common Tern *S. hirundo*) and *S. gracilis* (Roseate Tern *S. dougallii*) at Bird Islet the following month and Denham *S. gracilis* again around the central islands of the Chesterfield Reefs in April-May 1859 when a *Sterna* was listed on the track chart. While these may have been Black-naped Terns, possibly both breeding and wintering Roseate and wintering Common Terns might occur.

Sterna sumatrana Black-naped Tern. These may be the small terns reported by Denham and noted on his track chart on the Avon Isles. Hindwood et al (1963) reported it bred on a cay on Wreck Reef and was seen on Porpoise Cay and Cato Island. Rancurel (1973) saw it on the Anchorage Islets in April 1973 and Condamin (1977) found two there 4 October 1977. Terry Walker reported it on Cato Island, Bird Islet and the central islands of the Chesterfield Reefs.

Sterna nereis/albifrons Fairy/Little Tern? The small local race of Fairy Tern *S. n. exsul* breeding in New Caledonia and reported along the Australian Great Barrier Reef (McKean, 1978) has a dark tip to the bill similar to the Little Terns *S. albifrons* nesting along the Great Barrier Reef so the identification of small terns in this region presents problems (Hitchcock, 1959; Higgings and Davies, 1996). Denham reported *Sternula nereis* nesting on Observatory Cay on Middle Bellona Reefs in September 1858. Rancurel (1973, 1974b) saw birds resembling *S. nereis* with dark marks on the bill around New Caledonia and in the Chesterfield Islands from 1973, Naurois and Rancurel (1978b) found unidentified birds and 20 nests with 1-2 eggs or young in the Chesterfield Islands on 25 June 1976, and Condamin (1977) found 12 on the Anchorage Islets and several on Long Island on 4 October 1977. Terry Walker also saw terns of this group in the central islands of the Chesterfield Reefs.

Sterna fuscata Sooty Tern. Denham found many *Onychoprion fuliginosus* breeding on Observatory Cay on Middle Bellona Reefs in September 1858 and on Bird Islet and Cato Island the following month when F.M. Rayner collected a male now in Museum Victoria. Returning on 21 April 1859, Denham again saw streams passing west at 23 04 S, 158 05 E towards Cato Island 200 km away. They were also reported around the central islands of the Chesterfield Reefs and on the track chart and Beale collected a pair now in Museum Victoria on the Avon Isles in May 1859. Froude took "*O. panaya*?" (usually applied to Bridled Terns *S. anaethetus* but surely *S. fuscata*?) near the "Brampton Shoals" in July 1861 (Krefft, 1862). Rancurel (1973) found large chicks, many dead, on Loop Islet in April 1973 and Naurois and Rancurel (1978b) found thousands breeding again in the Chesterfield Islands in September 1973 and speculated that they may nest at intervals of less than a year. Condamin (1977) found several off the Bellona Reefs and 2-3000 with young on Loop Islet in early October 1977. These young regurgitated small reddish squid. He also saw some Sooty Terns on the Anchorage Islets and Long Island next day. Rancurel (1974a) found them less common on 18 April 1974 although some large chicks were still being fed in the evening. Most may nest in the spring. Terry Walker reported it still breeds commonly on Cato Island, Bird islet and on the central islands of the Chesterfield Reefs where he found 3650 breeding on North Avon Isle in December 1990.

Anous stolidus Common Noddy. Denham reported noddies breeding on Observatory Cay on Middle Bellona Reefs in September and on Bird Islet and Cato Island in October in 1858 and present (and possibly breeding?) around the central islands of the Chesterfield Reefs in April-May 1859 when *A. stolidus* was listed on the track chart. In June he reported first "Black Noddies *A. stolidus*" breeding on bare Kenn Reef but then "Black Noddies *A. leucocapillus*" breeding on similar Frederick Reefs nearby. These seem most likely to have been *A. stolidus* since *A. minutus* normally nests in trees in this area (Hindwood et al., 1963). There is a record of a specimen of *A. stolidus* taken on Frederick Reefs by G.B. Beale in June 1859 in Museum Victoria. Froude took an *Anous* resembling *A. melanogenys* Gray on "Brampton Shoals" in July 1861 (Krefft, 1862). This is presumably a Common Noddy specimen, P. 4519, in the Australian Museum collected at sea at 19° 05' S, 157° E on 16 June 1861. Thiercelin (1866) took many eggs from

his "petit oiseau noir" in the Chesterfield Islands in July 1863. Naurois and Rancurel (1978b) found eggs and chicks of *A. stolidus* in nests a few cm above the ground there in September 1973 and 1975, and Condamin (1977) saw 600 with a few large young on Loop Islet on 2-3 October 1977 and more noddies than Sooty Terns on the Anchorage Islets and Long Island. Rancurel (1974a) found many incubating in *Boerhavia* with no chicks yet on Loop Islet on 18 April 1974. Thus they may nest during much of the year. Hindwood et al. (1963) found it breeding on West Islet, Bird Islet and Porpoise Cay on Wreck Reef, Southwest Extreme and Observatory Cays on Kenn Reef and Herald's Beacon Islet on Mellish Reef. Terry Walker found it breeding commonly on Cato Island, Bird Islet and the central islands of the Chesterfield Reefs.

Anous minutus Black Noddy. Male birds in Museum Victoria were taken on Observatory Cay on Middle Bellona Reefs by F.M. Rayner in November 1858 and G.B. Beale on Mellish Reef in September 1859. While Denham reported *A. leucocapillus* breeding on Fredrick Reefs in June 1859, see comment under *A. stolidus*. Rayner also reported the former on Bird Islet in October 1858 and it appears with *A. stolidus* on the track chart. Rancurel (1973) found eggs and chicks in the Chesterfield Islands in April 1973 and birds perching on the meteorological station and starting to incubate in Faux Tabacs *Argusia argentea* on Loop Islet, but no chicks, on 18 April 1974 (Rancurel, 1974a). Rancurel and Naurois (1978b) found them nesting again in September in *Pisonia* and *Messerschmidia*, and Condamin (1977) saw nests and young of all sizes on 2-3 October 1977. Hindwood et al. (1963) failed to mention it, but Terry Walker found it on Cato Island and Bird Islet and old nests commonly in the central islands of the Chesterfield Reefs on December 1990 where he thought it was the only species that bred at a different season from those in the western Coral Sea. It may be one of the species affected by the destruction of vegetation in the guano-digging era? The nearest breeding colonies are on Norfolk and Matthew Islands.

Procelsterua cerulea Grey Noddy. Although it is not mentioned in Denham's journal, Rayner reports *Anous cinereus* on Bird Islet on 9 October 1878 and it is also listed opposite the central islands of the Chesterfield Reefs on the *Herald's* track chart. Terry Walker did not know of it in the area and there may have been confusion with the Little or Fairy Terns not mentioned in these lists.

Cuculus pallidus Pallid Cuckoo. A male in Museum Victoria was collected by F.M. Rayner off Cato Island in October 1858.

Eudynamis taitensis Long-tailed Cuckoo. Seen on Cato Island on 28 November 1961 (Hindwood et al., 1963).

Hirundo nigricans Tree Martin. One in Museum Victoria was collected by F.M. Rayner on Observatory Cay on Middle Bellona Reefs in September 1858. Stokes and Corben (1985) give other records on offshore islands including a body found on North Reef Cay on Frederick Reefs on 29 April 1980.

DISCUSSION

The presence of many fish, cetaceans and turtles around the islands in the southern Coral Sea implies that this must be a biologically productive area, presumably as a result of turbulence in the westbound south equatorial current and its southern branch, the East Australian Current (Burrage, 1993), around the reefs. The birds play an unusually important role in the ecosystem (Smith, 1993) by carrying marine nutrients ashore so that Hutchinson (1950: 362) reports that the Chesterfield Reefs and Huon islands were originally estimated to have over 500,000 cum of guano. The guano was said to consist of about two feet of loose "alluvial guano" over about two feet of "cement guano" composed of phosphatised coral sand and shell grit in the centre of Surprise Island in the Huon group (Power, 1925) and doubtlessly elsewhere. The observations by the *Herald* are interesting here because they are the best record of the situation in the middle of the 19th century before the islands were devastated by guano-diggers liable to take both the animals for food and the plants for fuel.

Apparently there were then many more whales than until recently, especially Humpbacks *Megaptera novaeangliae* inshore and Sperm Whales *Physeter macrocephalus* out at sea although rorquals *Balaenopteridae* and pilot whales *Globicephala* sp. were also present. They apparently occurred all around the islands although they were commonest off the south end of the Bellona Reefs. There were also many birds, including most species found today, and others not reported recently such as the Herald Petrel, one or two tropicbirds, the Roseate Tern and Grey Noddy. While some may have been misidentified in the past or overlooked until recently, as with two recent discoveries, the Crested and Black-naped Terns, the scarce species may have suffered from past predations whereas the commoner ones survived and all are now increasing again.

The local annual cycles of the seabirds seem particularly interesting. The islands lie between the area where most (but by no means all) seabirds normally lay in the local spring off south and east Australia, and where most lay in the autumn when the northward movement of the southeast tradewinds and development of the southerly Asiatic monsoons lead to seasonal upwelling in the winter off north and west Australia. Thus Serventy et al (1971) comment on the lack of information but suggest there may be double spring-and-autumn laying seasons in the central Coral Sea. Now that Naurois and Rancurel (1978a,b) have also discussed the area farther east around New Caledonia, it is possible to discern some trends.

So far most visits to the area have been made in the spring and autumn, producing few consistent results. However, while Denham is vague about individual species, he must have been able to assess the total amount of local seabird breeding activity fairly accurately because his crew was collecting the birds and especially their eggs for food. He remarks that though many birds were breeding on the southern islands in September and October 1858, when the Green Turtles *Chelonia mydas* were also laying, there were fewer birds breeding in April 1859 when the last young turtles were also leaving. On the other hand, although his crew does not appear to have found many chicks, apart from the fledging mutton-birds on Long Island and the Avon Isles 300 km

farther north, soon afterwards when they destroyed any set eggs they were soon replaced by fresh ones. In common with several more recent observers he deduced that some birds must also have been starting to lay again in the autumn. Thiercelin (1866) also appears to have found at least noddies breeding in July 1863. Terry Walker found some Wedge-tailed Shearwaters, boobies and frigates and one colony of Sooty Terns breeding in December 1990, but few other terns or noddies.

Unfortunately, it is still uncertain whether the breeding seasons of the individual species show any equally consistent pattern since several have been found breeding erratically in both the spring and autumn. This might be due to a variety of causes, such as the occurrence of "niño" years due to fluctuations in the south equatorial current, the passage of cyclones, variations in the food supply, the disturbance by people, or because the birds do not breed at annual intervals. Also these highly social birds may not all breed together but in a fluctuating stream that gives rise to a succession of synchronised breeding groups of different sizes dispersed around the available habitat providing an important means of avoiding both interactions between birds in different stages of the breeding cycle and also between some of the numerous predators and parasites ranging from seamen to ticks that infest seabird colonies.

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Table 1: Number of bird sites reported on the Chesterfield Islands (excluding Bampton and Bellona Reefs) by Walker & Savage (n.d.) in December 1990 compared with Walker's ms maxima since the survey by Hindwood et al (1960) for the main colonies in the western Coral Sea, and estimates for NE Herald Cay farther north (Comben and Beruldsen 2001).

Location:	Chesterfield Is	Cato Id	Wreck Reef		Kenn Reef		Herald Cays
			Porpoise Cay	Bird It	Obsy Id	SW Cay	NE Cay
Character:	S-B	V	V	V	V	S	B
Wedge-tailed Shearwater	35000	13000		Large			62250+
<i>Puffinus pacificus</i>							
Great Frigatebird	630	46					100s
<i>Fregata minor</i>							
Lesser Frigatebird	118	550	1	+		1	1000s
<i>Fregata ariel</i>							
Brown Booby	302	1200	80	1275	61	53	10
<i>Sula leucogaster</i>							
Red-footed Booby	914	25		Small			1000+
<i>Sula sula</i>							
Masked Booby	464	700	54	200	22	20	53
<i>Sula dactylatra</i>							
Red-tailed Tropicbird	?						386
<i>Phaethon rubricauda</i>							
Crested Tern	+	7	9	4	7	7	+
<i>Sterna bergii</i>							
Black-naped Tern	+	6	25	7		16	12
<i>Sterna sumatrana</i>							
Sooty Tern	7800	50000	6	4500		100	+
<i>Sterna fuscata</i>							
Common Noddy	3300	8000	300	400	340	80	100s
<i>Anous stolidus</i>							
Black Noddy	1700	+			+	+	10000s
<i>Anous minutus</i>							

Character: S - Sand, V - Low vegetation, B - Bushes and trees, + - species present

Table 2: Birds recorded on the central islands and cays of the Chesterfield Reefs by Terry Walker (ms) and numbers estimated to be nesting on 11 of these islands and cays by Walker and Savage (nd) in December 1990.

Species:	WTS	GF	LF	BB	MB	RFB	BNT	ST	CN	BN
Long Island	on			650	300	199	2	1	200	300
Loop Islet	1		8	10	100	50	15	300		on
Passage Island	+	12	200	239	22	141	3	12	300	100
Passage) 1	+	30	3	65	6	131	2	2	250	150
Island) 2				48	3	2	16	2	200	
Cays) 3				6	8		2			
4				100						
N Anchorage 1.	b++	17		29	22	180	2	50	700	1
S Anchorage 1.	b	78		57	11	142		2	400	250on
Islets 1		2		32	50	23	20	1	150	
2	b			3	103	14	10		450	350on
3		55		11	170	9	6	2	200	400on
4				20	86	8	6	8	on	on
5				9	2	4	16		100	
S Avon Isle		2	1	20		14	3	500	10	
N Avon Isle	3b		16	42	22	34	180	3650	500	200on
Numbers estimated nesting	35000b	630	118	302	464	914		7800	3300	1700

Species:

WTS Wedge-tailed Shearwaters, GF Greater Frigatebirds, LF Lesser Frigatebirds, BB Brown Boobies, MB Masked Boobies, RFB, Red-footed Boobies, BNT Black-naped Terns, ST Sooty Terns, CN Common Noddies, BN Black Noddies; + - species present, b - burrow, on - old nests. Only three pairs of Common Noddies had active nests, and there were only old nests of Black Noddies. Not all the Shearwater burrows were occupied, and no Herald Petrels were found.

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